County of Hawaii
Drought Mitigation Strategies

Prepared for:

Hawaii Drought Committee

and

State of Hawaii
Department of Land and Natural Resources
Commission on Water Resource Management

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1 INTRODUCTION

As part of a statewide effort to address and mitigate the effects of natural hazards, the County of Hawaii has undertaken the development of strategies to mitigate the effects of drought. Drought is one of the most obstinate and pernicious of natural disasters which at its most severe form decimates crops and livestock, erodes the landscape, damages terrestrial and aquatic wildlife habitat, contributes to widespread wildfire, and results in hundreds of millions of dollars in damage. Drought moves slowly and manifests after months of below normal precipitation, and recovery requires much more than one good rainfall. Drought results from both climatic conditions and from human activities that increase demand for water.

Drought can lead to tough decisions regarding allocation of water, stringent water-use limitations in large urban areas, problems in ensuring safe drinking water and adequate water supplies for fire fighting efforts. In the past, drought was addressed as a temporary emergency. Actions were taken in response to impacts in a reactionary fashion. The most important lesson learned in recent years is that the best time to reduce the impacts of drought is before they occur. Therefore, it is important to develop a plan that advocates a proactive drought management approach. The County of Hawaii Drought Mitigation Strategies was developed with this approach in mind.

This report presents the mitigation strategies developed by the Hawaii Drought Committee as a result of workshops that were held on July 20, 22 and August 17, 2004. In order to reduce travel for Committee members, workshops were held in Hilo and Kona, with the final workshop held for the entire Committee in Waimea. The State Commission on Water Resource Management (CWRM), in cooperation with the State Civil Defense (CD), received Federal Emergency Management Agency (FEMA) assistance for the development of county drought mitigation strategies throughout the State of Hawaii. Workshops were undertaken to compile an inventory of existing drought mitigation programs, identify data gaps, identify drought risk areas, and recommend and prioritize drought mitigation projects. The Hawaii Drought Committee has decided it will continue to meet regularly and work cooperatively towards implementing the mitigation projects identified during the workshops.

2 BACKGROUND

The preparation of County Drought Mitigation Strategies is a part of a larger statewide drought planning framework. Statewide drought planning is guided by the *Hawaii Drought Plan* (HDP), which was most recently updated in 2004. In addition, drought mitigation planning is incorporated into the forthcoming *State of Hawaii Hazard Mitigation Plan* and each of the respective *County Multi-Hazard Mitigation Plans*.

2.1 Hawaii Drought Plan

The *Hawaii Drought Plan* provides a coordinated and consistent program and framework for integrating federal, State, county and private sector actions to reduce drought impacts. The plan is intended to serve as a working guide for those agencies and private entities that have the capabilities and resources to develop drought response and mitigation programs within their areas of jurisdiction.

The HDP includes a description of historical drought occurrences, current monitoring programs by federal, State and local agencies, climatological statistics, and risk assessments of susceptibility and vulnerability to drought. The plan emphasizes the identification of pre- and post- drought preparedness and mitigation measures for implementation by government agencies, stakeholders, and the general public.

The HDP recognizes County/Local Drought Committees (CLDCs) as an integral element for effective implementation of drought planning and mitigation. The plan anticipates that CLDCs will be the first to identify drought effects, be responsible for initial implementation of mitigation activities, and generally be the first to respond to and manage public health, safety and fire related issues.

2.2 State of Hawaii Hazard Mitigation Plan

To meet the requirements of the Disaster Management Act of 2000 and the planning guidelines by the Federal Emergency Management Agency, the State Department of Defense, Civil Defense Division is preparing the *State of Hawaii Hazard Mitigation Plan*, as well as plans for each of the four counties. At the time of this writing, the completion of the plan was anticipated by December 2004.

The Federal Disaster Management Act of 2000 requires each state and territory to conduct hazard mitigation planning and to implement projects to reduce hazard impacts prior to a disaster occurrence. This Act marked a fundamental shift in policy. Rather than placing primary emphasis on response and recovery, FEMA's focus broadened to incorporate mitigation as the foundation of emergency management.

Future funding for public assistance subsequent to disasters will be largely contingent upon mitigation plan completion. Additionally, states are required to have an

approved Standard State Mitigation Plan in order to receive additional Pre-Disaster Mitigation funds for state or local mitigation projects after November 1, 2004.

The Standard State Mitigation Plan will also be required for non-emergency assistance provided under the Stafford Act, including Public Assistance restoration of damaged facilities and Hazard Mitigation Grant Program funding. A state with a FEMA-approved Enhanced State Mitigation Plan at the time of a disaster declaration is eligible to receive increased funds under the Hazard Mitigation Grant Program, based on 20 percent of the total estimated eligible Stafford Act assistance. Therefore, the development of state and local hazard mitigation plans is key to maintaining eligibility for future FEMA mitigation and disaster recovery funding.

The *State of Hawaii Hazard Mitigation Plan* will encompass the broadest possible scope of disaster occurrences, focusing on nine natural hazards: hurricanes, tsunami, earthquakes, floods, volcanic eruptions and lava flow, coastal erosion, landslides, wildfire, and drought. Several of these hazard categories have current advisory boards or task forces that will be developing recommendations and strategies.

It is anticipated that some of the drought mitigation projects identified by CLDCs will be incorporated into the county and State hazard mitigation plans, thereby allowing these areas to be eligible for future assistance from FEMA.

2.3 County Multi-Hazard Mitigation Plan

The Disaster Mitigation Act of 2000 also requires the development of local or county plans for that particular county to be eligible for post-disaster funding. The purpose of these requirements is to ensure that there are local programs and projects in place that will help minimize the loss of life, property, and total cost of disasters.

Similar to the *State of Hawaii Hazard Mitigation Plan*, the county plans have been designed as multi-hazard mitigation plans. The initial *County Multi-Hazard Mitigation Plans* did not detail specific drought mitigation projects.

2.3.1 County Drought Mitigation Strategies

In order to develop county-specific drought mitigation strategies, the Commission on Water Resource Management conducted a series of workshops within each county. The resulting county-specific drought mitigation strategies, which are documented in this report, can be incorporated into each *County Multi-Hazard Mitigation Plan*. Formulation of these mitigation strategies resulted in the development of specific project proposals, which are documented in the *Drought Mitigation Strategies* report. The CLDC and the county can then choose to seek funding for these projects through FEMA or other sources. The CLDC will have the lead role in implementing

projects identified in their *Drought Mitigation Strategy* with assistance from the State Civil Defense Division, the Hawaii Drought Council, and the State Drought Coordinator.

The primary objectives of the county workshops were to establish standing CLDCs and improve the coordination and implementation of local drought mitigation and response actions. The CLDCs play a key role in Hawaii's drought leadership structure by providing directives and allowing for stakeholder representation at the county/local level. Improved coordination and project implementation will arise from better communication between government agencies and the private sector, from enhanced monitoring and data collection, and through the development of immediate and near-term drought mitigation strategies.

The expected outcomes of the county workshops included the following:

1. Identification of current mitigation measures and existing data gaps in drought information/planning;
2. Development and prioritization of county-based drought mitigation strategies, including ranking criteria for project selection and identification of priority mitigation projects which may be eligible for agency funding.
3. Transition from "emergency response" to early "proactive" mitigation;
4. Improved post-drought impact assessment; and
5. Validation of drought response/mitigation measures.

3 HAWAII DROUGHT COMMITTEE

3.1 Membership and Leadership

The Hawaii County/Local Drought Committee (hereafter referred to as "Hawaii Drought Committee") is comprised of representatives from key governmental agencies, non-governmental organizations, and major landowners with an active interest in drought-related issues. Based on participation in the drought workshops, the present membership includes the following agencies and entities:

- Hawaii Department of Water Supply
- Hawaii Fire Department
- Department of Agriculture
- Department of Hawaiian Home Lands
- Department of Land and Natural Resources, Division of Forestry and Wildlife
- US Department of Agriculture, Farm Service Agency
- US Department of Agriculture, Natural Resource Conservation Service
- Hawaii Soil and Water Conservation Districts

- Kahua Ranch
- Mac Farms Hawaii
- Ponoholo Ranch
- Hawaii Farm Bureau Federation
- West Hawaii Wildfire Management Organization

Representatives participated in workshop sessions held in July and August 2004 and shared local knowledge and information about current drought conditions, and past experiences coping with drought. Through facilitated discussion, the group collectively developed local and regional drought mitigation strategies to minimize the effects of drought upon domestic and municipal water supplies, fire suppression activities, agricultural water use, and the environment.

Committee members participating in the workshops generally agreed that drought planning is a worthwhile effort deserving of continuation. Post-workshop consultation with the Mayor's Office determined that the Hawaii County Civil Defense Agency will act in the capacity of committee chair for the Hawaii Drought Committee.[1]

3.2 Relationship to State Drought Leadership

The *Hawaii Drought Plan* establishes a drought leadership structure that, in addition to the County/Local Drought Committees, consists of the Hawaii Drought Council, the State Drought Coordinator, and the Water Resources Committee. The purpose of each of these groups/entities and their relationship to the Hawaii Drought Committee is as follows:

Hawaii Drought Council. The Hawaii Drought Council is the steering group that oversees the statewide coordination of drought-related activities. The Drought Council currently functions within existing agency authorities and responsibilities, and facilitates access to services and/or assistance to lessen the impacts of drought.

The Drought Council serves as the liaison between the various entities involved with drought planning/response, including the Hawaii Drought Committee and the Office of the Governor. It also assumes the lead role in intergovernmental drought response coordination and media information releases.

State Drought Coordinator. The State Drought Coordinator is responsible for coordinating drought-related actions and communications between federal, State, and county agencies, stakeholders, and the general public. The State Drought Coordinator position resides in the Commission on Water Resource Management.

[1] Email correspondence on September 20, 2004 from Mr. Wendell Hatada, Executive Assistant to Mayor Harry Kim, to Neal Fujii, State Drought Coordinator, confirmed that the Hawaii County Civil Defense will serve as the lead agency for the Hawaii County Drought Committee.

The State Drought Coordinator will serve as the principal liaison between the Hawaii Drought Committee, the Hawaii Drought Council, Water Resources Committee, and other government agencies.

Water Resources Committee. The Water Resources Committee monitors all available climatological data, reservoir storage levels, ground water conditions, weather forecasts and other pertinent information necessary to analyze the current status and forecasted level of drought conditions throughout the State.

Information gathered by the Water Resources Committee will be available to the Hawaii Drought Committee through the State Drought website and reports distributed by the State Drought Coordinator.

3.3 Role and Responsibilities

3.3.1 Coordination and Communication with Government Agencies and Stakeholders

The Hawaii Drought Committee will serve as a focal point for the exchange of information between federal, State, and county agencies, local stakeholders, and the Hawaii Drought Council. The Hawaii Drought Committee will be responsible for monitoring drought conditions, gathering data, and forwarding information to the Hawaii Drought Council via the State Drought Coordinator. In turn, the State Drought Coordinator will provide data gathered by the Water Resources Committee to the Hawaii Drought Committee for distribution to local agencies and stakeholders.

3.3.2 Data Collection and Drought Monitoring

The Hawaii Drought Committee is uniquely qualified to provide information on crop and livestock impacts, reservoir water levels, stream conditions, ground water levels, and other drought issues at the County level. The Hawaii Drought Committee should assist in monitoring ground water levels, stream/ditch conditions, and reservoir levels. The Hawaii Drought Committee should also monitor and assess current and potential impacts of impending or ongoing drought, focusing upon impacts to the local economy, the environment, and natural resources.

Following each drought event, the Hawaii Drought Committee should take the lead in conducting a post-drought evaluation. Post-drought evaluations will assist in documenting statewide drought impacts and will serve to assess the effectiveness of specific response and mitigation measures implemented at both the State and county level. Upon development, the State Drought Coordinator will assist the Hawaii Drought Committee in applying a standardized methodology to document economic, environmental, and social drought impacts.

3.3.3 Mitigation Actions

Planning for drought mitigation activities is a key function of the Hawaii Drought Committee. Drought mitigation projects identified by the Hawaii Drought Committee are discussed in chapters 5 and 6 of this report. It is the responsibility of the Hawaii Drought Committee to carry out activities in pursuit of the following:

- Further refinement and/or delineation of areas of drought risk;
- Application, receipt and administration of funds for the implementation of identified projects; and
- Provision of oversight and management of project implementation.

The State Drought Coordinator, the Hawaii Drought Council, and the Water Resources Committee are available to provide the Hawaii Drought Committee with technical assistance and aid in the identification and acquisition of funds for project implementation. The Hawaii Drought Committee is also responsible for the periodic review and appropriate revision of county drought mitigation strategies, adding, deleting or refining projects to reflect changing circumstances and priorities.

3.3.4 Response Actions

During drought, the Hawaii Drought Committee will be responsible for initiating appropriate and coordinated drought response activities within the capabilities of local government agencies, and any State or federal drought programs. The Hawaii Drought Committee should advise the Hawaii Drought Council of any needs that cannot be met through existing Hawaii County resources. The Hawaii Drought Committee will be the point of contact for the State Drought Coordinator relative to providing drought information and seeking assistance for response actions and documentation of impacts. The activities of the Hawaii Drought Committee during drought periods should include the following actions:

- Meet at least semi-annually to discuss drought impacts and planned response actions;
- Monitor drought impacts and communicate this information to the Hawaii Drought Council via the State Drought Coordinator;
- Make recommendations as necessary for the issuance of county/local drought declarations in coordination with the Hawaii Drought Council and other Hawaii County offices and agencies; and
- Provide for outreach activities targeting affected stakeholders with the purpose of determining needs, identifying detailed emergency assistance response actions or projects, and requesting relief funding from the appropriate source with assistance from the State Drought Coordinator.

4 DROUGHT RISK AND VULNERABILITY FOR THE COUNTY OF HAWAII

In September 2003, the Commission on Water Resource Management completed a statewide *Drought Risk and Vulnerability Assessment and GIS Mapping Project*. The risk and vulnerability assessment illustrates the spatial extent and severity of drought risk for different impact sectors throughout the state. Areas in the County of Hawaii identified in the report as subject to drought risk are shown in the table below.

County of Hawaii Drought Risk Areas			
Sector	**Drought Stage**		
	Moderate	**Severe**	**Extreme**
Water Supply	Kona, South Point	Kona, Kau	Kona, windslopes of Hamakua
Agriculture and Commerce	Kona, windward slope of Hamakua	Kona / western slopes of Mauna Loa near Kealakekua	Kona / Kailua
Environment, Public Health & Safety (based on 12-month time scale)	Waikoloa, Kona	Kona coast	Kona

Adapted from: Table 6.4 Drought Risk Areas for the Hawaii County, *Drought Risk and Vulnerability Assessment and GIS Mapping Project*, prepared for the State Commission on Water Resource Management, September 2003

The Hawaii Drought Committee examined the findings of the drought risk report and, through group discussion of areas of concern and drought impact sector issues, generated a revised list of specific geographic areas of the county that are most susceptible to drought. It was noted that areas that rely on catchment are particularly vulnerable to drought.

The table below summarizes the areas identified by the group as having the highest drought risk:

Drought Risk Areas Identified by the Hawaii Drought Committee	
Impact Sector	**Drought Risk Areas**
Water Supply	- Puna - Ocean View - Pohakuloa - South Kona (Hookena and southward) - Parts of Waimea, including Kawaihae district and South Kohala - Hamakua - Kaumana City - All areas on catchment - Kona - Kau - Waikoloa - Makuu
Agriculture	- Waimea - Puna - Kau-South Point, Pahala, Naalehu - Hamakua - Kohala, North and South - Keahole - Kona, North and South - Humuula/Piihonua - Makuu
Wildland Fire	- South Kohala including Kawaihae - North Kona including Puuwaawaa and Puuanahulu - Kau-Naalehu, South Point, Pahala - Makai sections of North Kohala - Puna - Waimea - Hamakua - Pohakuloa

5 EXISTING DROUGHT RESPONSE AND MITIGATION ACTIVITIES FOR THE COUNTY OF HAWAII

The following sections summarize the existing drought response and mitigation efforts and programs in the County of Hawaii. "Drought response" refers to emergency actions that are implemented directly in response to drought conditions. In contrast, "Drought mitigation" is defined as short- and long-term actions and/or programs that may be implemented prior to, during, and after drought events to reduce the severity of drought impacts to human life, property, and the economy. Drought response and mitigation activities are presented for each of three impact sectors: Wildland Fire, Agriculture, and Water Supply. Challenges and issues related to these existing programs are also summarized.

5.1 Current Drought Response Activities

5.1.1 Wildland Fire Impacts

For fires on DOFAW jurisdiction, the State Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW) maintains contracts for the use of heavy equipment, such as water tankers and helicopters, to respond to wildfires. Larger landowners also cooperate by providing water from reservoirs during fire.

The County of Hawaii Fire Department responds to fires within County jurisdiction. The Hawaii Fire Department also may provide support to DOFAW for fires on DOFAW jurisdiction lands and vice versa. The County Police Department also provides support if road closures are necessary. The Red Cross is involved when residents are evacuated from their homes.

5.1.2 Agriculture and Commerce Impacts

The U.S. Department of Agriculture (USDA), Farm Service Agency (FSA) administers a program that provides emergency feed for livestock after a drought has been declared by USDA. The USDA also administers the Emergency Conservation Program, which provides assistance for storage and wells. In the past five years, the FSA has made five drought declarations.

The State Department of Agriculture (DOA) monitors water use on their systems and in times of low flow can impose voluntary and mandatory cut backs and use restrictions on their customers, such as the rotation of water use.

5.1.3 Water Supply Impacts

The County Department of Water Supply (DWS) issues Conservation Notices or Reduction Notices, as appropriate. Newspaper and radio public service announcements are also utilized for public outreach, however the DWS does not

have a formal conservation program. The DWS also does not have the personnel to monitor compliance with use restrictions or to enforce such restrictions. Therefore, customers are not penalized if they fail to comply with reduction notices.

The DWS system is not interconnected; there are more than 20 separate water systems. The County of Hawaii has both public and private water systems and there have been instances where the DWS has provided water to private systems during emergency situations, and instances of mechanical problems or system failure. The private systems have also provided interconnections to the public water system during emergencies. Private land owners provide assistance during drought by providing access to water sources. Surface sources are also available to DWS for emergency use.

Persons who rely on catchment may collect water from the DWS system from emergency spigots installed along the roads to provide drinking water for catchment users during drought. However, as access to the spigots is not restricted, water tends to be consumed continuously at these locations by a variety of users. Currently, the Hawaii County Civil Defense Agency reimburses DWS for the cost of the water consumed at these spigots. The DWS is reviewing the spigot program and may institute changes to encourage conservation, including charging for the water on-site.

DWS's priority is to provide water for human consumption and the Department encourages conservation of water by their agricultural customers during drought.

5.2 Current Drought Mitigation Activities

5.2.1 Wildland Fire Impacts

The DOFAW has Mobilization Plans for wildland fire and tries to maintain a consistent level of preparedness year-round. Currently, a federally funded wildfire management study is underway in Puuanahulu along Mamalahoa Highway. This multi-agency demonstration project involves DOFAW, the U.S. Fish and Wildlife Service, the Department of the Army, the U.S. Forest Service, the County Fire Department, the Natural Resource Conservation Service (NRCS), and Puuwaawaa Cattle Company. The purpose of the project is to evaluate the effectiveness of wildfire mitigation techniques, including cattle grazing, aerial herbicide spraying, and prescribed burn activities over a 2-year period. Site visits may be arranged to demonstrate to interested landowners how fire load and threat changes over time.

The County Department of Public Works (DPW) maintains a list of heavy equipment and updates the list on a weekly basis so that the equipment can be mobilized when needed. The DPW pre-positions the equipment to prepare for wildland fires, especially prior to long weekends.

The County of Hawaii has good interagency and community coordination. The West Hawaii Wildfire Management Organization (WHWMO) is working cooperatively with the Big Island Wildfire Coordinating Group and other agencies to increase community awareness and mitigate hazards in communities. Several communities have begun to implement wildfire management strategies including Waikoloa, Puako, Wailea Bay, Puuanahulu and Waikii Ranch.

The WHWMO has received a wildland urban interface grant (U.S. Forestry funds) to build an islandwide inventory of wildfire resources. Key partners in this effort include the County Fire Department and DOFAW.

Currently, there are no County rules that require residential subdivisions to participate in wildland fire mitigation. Some mitigation measures, such as implementation of the national Firewise program and the revision of building codes (i.e. discouraging the use of shake roof material) are in place. The County Fire Department is focusing on compliance with County regulations for new subdivisions to reduce wildland fire hazard, such as requiring adequate fire access, hydrant placement, water system sizing, etc.

The Department of Hawaiian Home Lands (DHHL) is constructing a one million gallon reservoir in the Kawaihae area strictly for fire suppression. The DHHL had also drilled two exploratory wells in Kawaihae but one was too salty and one did not have adequate yield.

5.2.2 Agriculture and Commerce Impacts

Constructing reservoirs and water tanks has increased water storage. The reservoirs have been sized with excess capacity to provide water during drought. The increased storage and the construction of new wells have helped reduce the amount of water that must be trucked to farms during drought. Interconnecting private and public water systems has also provided more flexibility and more storage. The USDA NRCS Watershed Management Program can provide funding for design and construction of source wells, reservoirs and surface water systems.

Mitigative actions that agricultural producers may implement include altering the crop type or amount of acreage planted based on drought forecasts. Ranchers may also reduce the herd size to respond to the reduced carrying capacity of pastureland. Agricultural producers are also encouraged to implement soil moisture conservation practices, such as mulching and drip irrigation. The USDA has cost share programs in place to help farmers transition to more efficient irrigation systems. The USDA cost share can be as high as 90%.

As for State DOA mitigation activities, capital improvements are continually being done on DOA systems as funding permits. The purpose of these improvements is primarily to conserve water, and is not specifically for drought mitigation, but for system efficiency.

The DHHL is involved in the Waimea-Paauilo Watershed Project that will provide water to agricultural users. Currently, there is sufficient water for agricultural users in Waimea because not all DHHL lands are being farmed. However, if all DHHL lots were in production, the system would be strained to provide water for all users in Waimea.

5.2.3 Water Supply Impacts

In order maximize operational efficiency of the County water system, the DWS is investigating transmission losses throughout the system. Two staff members have been specifically tasked with this effort. The DWS is also working on a master plan, which is anticipated to be completed in one to two years. The master plan may include a revised rate structure that takes into consideration conservation incentives.

A project that involves erecting eight permanent community water stations to replace the existing emergency roadside water spigots is currently underway. This project is administered by the DWS with funding from an EPA grant. Upon completion of the project, most of the existing spigots will be removed.

5.3 Existing Gaps in Drought Mitigation

The Hawaii Drought Committee reviewed presently available information supporting their drought mitigation efforts and identified gaps in data, related deficiencies and concerns, and offered suggestions for improvements. Mitigation projects were "brainstormed" for the geographic areas that the Committee had identified as being at risk to drought.

5.3.1 Wildland Fire Mitigation Needs

The committee developed the following list of mitigation projects for areas at risk to wildland fire drought impacts:

- Develop a map of water resources, access points, gates, bridges, capacity of bridges, etc for priority wildland fire areas.
- Do not abandon reservoirs (i.e. Lalakea reservoir), as they are important for public safety.
- Install dry hydrants in reservoirs in high priority areas.

- Restore the Halepiula water system.

- Provide funding to cut and maintain firebreaks in urban interface areas within the high priority areas of Kawaihae, Waikoloa, Waimea, North and South Kohala.

- Expand the use of prescribed burns to reduce fire danger.

- Establish Remote Automated Weather Stations (RAWS) in priority areas (North Kohala, South Kohala, Kau, Kona, Mauna Kea) and other portions of the County.

- Investigate the use of agricultural practices such as grazing, mowing, changing vegetative plantings, etc. to reduce fire danger. For example, grazing could be used in Puukapu to reduce wildfire risk.

- Make recommendations that include revision of county zoning codes to establish fire setbacks and larger interfaces between urban and natural areas.

- Seek funds to expand fire prevention and education programs.

- Ban fireworks in Hawaii County.

- Work with State and County transportation departments to improve roadside vegetation management to reduce the risk of vehicle-induced fires.

- Work with the State Department of Health to review the air quality permitting process to allow the expanded use of prescribed burns.

- Widen road shoulders on Highway 190 between the Waikoloa and Kona areas to reduce the possibility of vehicle-induced fires.

- Increase and seek additional funding for programs to replace invasive plant species that may promote fires (i.e. fountain grass) with native species.

5.3.2 Agriculture Mitigation Needs

The committee developed the following list of mitigation projects for areas at risk to agriculture drought impacts:

- Rehabilitate and improve tunnels and ditches in Waimea, Hamakua, Kohala, and Kau irrigation systems to increase water supply and minimize system losses.

- Renovate old plantation wells in the Pahala, Honokaa, and Kohala areas to provide additional sources during drought.

- Construct new wells and/or surface water diversions, as well as storage and transmission lines in priority areas to provide additional sources during drought.

- Improve efficiency of irrigation systems (i.e., leak detection).

- Conduct an evaluation of possible hydroelectric power sites on existing irrigation systems that could be implemented to offset pumping costs. Hawaiian Electric is conducting a study on existing high-altitude sites where small plants could be installed, and the selection criteria of this study should be noted and considered in the evaluation carried out by the Hawaii Drought Committee.

- Construct a water transmission line from the wet east side to the dry west side of the island (Saddle Road alignment). There is an existing DLNR engineering report on this idea.

- Promote better irrigation practices and water management. Investigate new irrigation technologies.

- Promote gray water reuse for agriculture.

- Continue the analysis for future development of an agricultural water system for the southern end of South Kona, including the Honomalino Irrigation project.

- Use reclaimed water from the Kealakehe wastewater treatment facility in Kona for golf course, park, or agricultural irrigation.

- Investigate possible partnership opportunities between DWS and State and Federal agencies to develop agricultural water systems in Kona.

5.3.3 Water Supply Mitigation Needs

The committee developed the following list of mitigation projects for areas at risk to water supply drought impacts:

- Improve access to community water stations and develop additional stations for persons on catchment in priority areas. Investigate methods to recoup the cost of providing water. This project is currently underway (see Section 5.2.3).

- Develop wells, storage, and transmission systems for Puna, Oceanview, Puukapu (DHHL), and Kawaihae (DHHL) areas.

- Develop possible incentives, grants, and cost-share ideas that could be implemented to increase the minimum size of catchment systems required by the County.

- Upgrade the transmission system, storage, and construct new wells for Kona-Keahole area.

- Improve water conservation and watershed management education, especially for persons on catchment. Investigate the use of tree plantings to increase water yield of watershed.

- Consider developing programs to provide community-based catchment storage areas.

- Construct reservoirs and investigate groundwater recharge methods for areas where ground-water levels are depleting.

- Investigate opportunities for desalination in priority areas.

- Construct new wells, storage facilities, and transmission systems in all priority areas.

6 COUNTY OF HAWAII DROUGHT MITIGATION STRATEGIES

This section summarizes drought mitigation strategies for Hawaii based on the input received at the first workshop. Committee members described existing drought mitigation programs and efforts, and relayed gaps in data and areas where improvements are needed. Areas susceptible to drought were identified, and various projects were proposed to help mitigate future occurrences of drought. Drought-related discussions of programs, concerns, and proposals were organized into the three main categories of impacts: wildland fire, agriculture, and water supply.

The goal of the CLDC workshops was to brainstorm strategies to guide the identification of future mitigation projects and the formulation of project descriptions. The following sections describe:

- Methodology for Project Prioritization
- "High" Priority Projects
- "Other" Priority Projects

6.1 Methodology for Project Prioritization

A prioritization process was undertaken by the Hawaii Drought Committee to categorize the proposed mitigation projects. This resulted in lists of "high" and "other" priority projects for each impact sector.

Some general guidelines were introduced for consideration during the project prioritization discussion, and are listed below:

- Potential impacts to people;
- Potential impacts to critical natural resources (endangered species habitat, watersheds, cultural resources, erosive soils, etc.);
- Potential impacts to economic resources (jobs, agriculture sector, tax revenues, etc.); and
- Impacts to critical government services (emergency services, water supply, health & human safety).

Generalized timelines were also agreed upon for high priority projects to indicate whether the projects were intended for immediate and/or long-term implementation.

For high priority projects, the Committee members developed detailed project descriptions, utilizing a form developed by the Hawaii Hazard Mitigation Forum. These forms provide project justification and estimated cost information to support the future pursuit of funding and implementation activities. These forms are reproduced in section 7.3 of this report and should be updated and revised as more information becomes available.

6.2 Summary of "High" Priority Projects

Summaries of the "high" priority projects for all impact sectors with preliminary cost estimates and general implementation time frames, as voted on and agreed to by the committee, are as follows:

Hawaii Drought Committee High Priority Drought Mitigation Projects			
Drought Impact Sector	**Mitigation Project Description**	**Preliminary Cost Estimate**	**Implementation Timeframe**
Wildland Fire	**Wildland Fire Mitigation Resource Mapping and Inventory Program:** Continue the development and maintenance of a GIS map and database to identify the location, type, and contact information for various widland fire protection resources.	$75,000	Immediate
	Establish and maintain firebreaks around roads and communities in North and South Kohala districts (includes the Kawaihae, Waikoloa, and Waimea communities)	$2,200,000	Long Term
	Install dry hydrants and develop static water sources: The water source/dry hydrant will allow fire trucks to refill their water tanks when fighting forest and grassland fires in the Hamakua area.	<$10,000	Immediate Long Term
	Remote Automated Weather Stations: Establish and maintenance Remote Automated Weather Stations in the districts of North Kohala, South Kohala, Kau, Kona, and Mauna Kea.	$85,000	Immediate Long Term
	Use of prescribed burns to reduce fuel loads in fire prone areas of Hawaii County: Use prescribed burns in fire prone areas including the communities of Waimea, Kawaihae, Puako, Waikoloa, Puu Anahulu, and Kailua-Kona.	$1,100,000 annually	Immediate Long Term
	Roadside fuel management: Develop and maintain a roadside fuel management program along an identified corridor of Highway 190, South Kohala/North Kona.		Immediate Long Term

Hawaii Drought Committee High Priority Drought Mitigation Projects			
Drought Impact Sector	**Mitigation Project Description**	**Preliminary Cost Estimate**	**Implementation Timeframe**
	Agricultural practices to mitigate wildland fires in communities and subdivisions: Continue to investigate and expand agricultural practices to mitigate wildfire impacts on communities and subdivisions, for example, grazing in Puukapu.		Immediate
Agriculture	**Improvements to old plantation irrigation system tunnels and ditches: Lower Hamakua Ditch System**	$30,000,000	Long Term
	Renovations/improvements to old plantation irrigation system tunnels and ditches: Kau Sugar System	$2,500,000 to $3,000,000	Long Term
	Improvements to old plantation irrigation system tunnels and ditches: Waimea	$26,000,000	Long Term
	Improvements to old plantation irrigation system tunnels and ditches: Kohala		Long Term
	Renovate old plantation wells in Pahala	$2,000,000 to $2,500,000	Long Term
	Renovate old plantation wells in Honokaa	$100,000	Long Term
	Renovate old plantation wells in Kohala		Long Term
	Construct new wells, surface water diversions, storage and transmission lines in priority areas		Long Term
	Irrigating wisely: Promote better irrigation practices and water management.	$50,000 to $100,000	Immediate
	Agricultural Water System for Kona, Honomalino: Provide a reliable source of water for agriculture and fire fighting assistance.		Long Term

Hawaii Drought Committee High Priority Drought Mitigation Projects			
Drought Impact Sector	**Mitigation Project Description**	**Preliminary Cost Estimate**	**Implementation Timeframe**
Water Supply	**Emergency Community Water Stations:** Improve access to community water stations and develop additional stations for persons on catchment in priority areas. Also, investigate methods to recoup the cost of providing water.	$1,000,000	Immediate
	Develop wells, storage, and construct transmission systems for Puukapu	$2,000,000 to $20,000,000	Long Term
	Development and extension of domestic water transmission system for Kawaihae	$10,000,000	Long Term
	Development and extension of domestic water transmission system for Oceanview		Long Term
	Develop wells, storage, and construct transmission systems for Puna		Long Term
	Makalei Water System Improvements: Develop additional wells and reservoirs as well as upgrade the transmission system in the area from Keahole to Kailua-Kona.	$5,000,000	Long Term
	Water Conservation and Watershed Management Education: Mitigate the effects of drought by increasing the public's awareness of water conservation and watershed management.		Immediate
	Various Water System Improvements within the County of Hawaii: Develop additional sources, storage facilities, as well as upgrade the transmission and distribution systems in high priority areas.	$49,000,000	Long Term

6.3 Summary of "Other" Priority Projects

"Other" priority projects for each sector as voted on and agreed to by the committee are as follows:

Hawaii Drought Committee Other Priority Drought Mitigation Projects	
Drought Impact Sector	**Mitigation Project Description**
Wildland Fire	Change county building codes to establish setbacks and a larger interface between urban and natural areas.
	Seek funds for a fire prevention and education campaign.
	Ban fireworks.
	Do not abandon reservoirs, such as Lalakea reservoir.
Agriculture	Improve the efficiency of systems (i.e. leak detection).
	Evaluate possible hydroelectric power sites on existing irrigation systems.
	Construct a transmission line from the wet, east side of the island to the dry, west side.
	Promote gray water reuse for agriculture.
Water Supply	Develop possible incentives, grants, and cost-share ideas that could be implemented to increase the minimum size of catchment systems required by the County.
	Consider developing programs to provide community-based catchment storage areas.
	Construct reservoirs and investigate groundwater recharge methods for areas where ground water levels are depleting.
	Investigate opportunities for desalination in priority areas.

7 SUMMARY AND RECOMMENDATIONS

Members of the Hawaii Drought Committee actively participated in a set of facilitated workshop sessions to develop mitigation strategies with the purpose of proactively addressing the impacts of drought at the County and local level. Representatives from agencies and organizations shared local knowledge and information about current drought conditions, past experiences in dealing with drought, and collectively developed local and regional drought mitigation strategies to minimize the impacts and reduce the risk of drought upon the domestic and municipal water supply, wildland fire-prone areas, agricultural operations, and the environment.

The workshops were successfully concluded with the identification of 25 priority projects, which are categorized as they relate to the major drought impact sectors of wildland fire, agriculture, and water supply. These priority projects can be pursued by

the Committee and associated lead agencies for immediate and long-term implementation.

7.1 Recommendations and Issues to Consider in Future Drought Mitigation Planning

The following issues were discussed in the workshops and should be considered in future drought mitigation planning. These recommendations are consistent with the goals and objectives of the Hawaii Drought Plan.

7.1.1 Formalization of Hawaii Drought Committee

The Hawaii Drought Committee agreed to convene meetings at least semi-annually, with the possibility of quarterly meetings depending on leadership and needs. The Committee agreed to earnestly work towards implementing the priority mitigation projects identified during the workshop process. There was general consensus among Committee members participating in the workshop that Committee meetings are worthwhile and deserving of continuation. The Hawaii Drought Committee should consider whether it should become a formalized entity through recognition by the Mayor or the Hawaii Hazard Mitigation Steering Committee.

7.1.2 Project Implementation and Funding Strategy

Project implementation should be focused on those projects that have been identified as having an immediate need and which are most easily achieved. The Hawaii Drought Committee should seek planning or project funding opportunities through existing government programs, private foundation grants, and county, State, or federal appropriations. Forming partnerships with existing groups (i.e., watershed partnerships, water user cooperatives, etc.) and coordinating mitigation projects will help leverage any funding opportunities or cost-sharing requirements.

7.1.3 Hawaii Drought Mitigation Strategy Update

This report has been prepared in manner such that it could be readily incorporated into the County of Hawaii Natural Hazards Mitigation Plan or function as a stand-alone report. The Hawaii Drought Committee should work together with the Hawaii Hazard Mitigation Steering Committee to ensure that this report's findings are represented in the next revision of the County of Hawaii Natural Hazards Mitigation Plan. This report should be evaluated and updated on a regular basis in consultation with the Hawaii Hazard Mitigation Steering Committee.

7.1.4 Drought Impact Assessment/Post-drought Evaluation

In order to effectively document the impacts of drought, the Hawaii Drought Committee should work with the Hawaii Drought Council and the State Drought Coordinator to apply a standardized methodology to document economic,

environmental, and social drought impacts. A post-drought evaluation is also recommended to evaluate the efficacy of mitigation and response actions executed by government and private sector organizations, and to make recommendations for improvement.

7.1.5 Drought Response Project Identification

Although this report focuses on preparedness and mitigation, there may be circumstances where emergency assistance is necessary to alleviate drought impacts to stakeholders. Limited federal program funding may be available to help with emergency drought relief. In these cases the Hawaii Drought Committee should assess and identify these needs within the community and provide a detailed description of drought assistance projects to the State Drought Coordinator, who will submit project proposals from all affected counties for any available federal program assistance.

7.2 Future Hawaii Drought Committee Operational Activities

The Hawaii Drought Committee agreed to hold meetings at least semi-annually and possibly quarterly. Critical times for meetings include: 1) December - prior to the Hawaii legislative session and the upcoming Congressional session, and 2) June - just prior to the end of the Federal fiscal year when funds may become available on short notice. The Hawaii County Civil Defense Agency will serve as the lead for the Hawaii Drought Committee.[2] Members of the Hawaii CLDC are urged to collaborate on the development of meeting agendas and to share responsibilities for meeting coordination.

7.3 Project Forms

For identified high priority projects, Committee members developed more detailed project descriptions using the format provided by the State Hazard Mitigation Forum. A project form was used to enable consistent project descriptions and includes general project justification and cost information to support the pursuit of project funding and implementation. Specific project details should be developed upon selection of a project for implementation.

The project forms are provided for reference on the following pages. These forms should be updated and revised as more information becomes available.

[2] Email correspondence on September 20, 2004 from Mr. Wendell Hatada, Executive Assistant to Mayor Harry Kim, to Neal Fujii, State Drought Coordinator, confirmed that the Hawaii County Civil Defense will serve as the lead agency for the Hawaii County Drought Committee.

Index of Project Forms

Index of Project Forms (continued)

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM: WF-1

<table>
<tr><td colspan="2">Jurisdiction: County of Hawaii</td><td colspan="2">Agency/Organization: County of Hawaii Fire Dept., BIWCG, WHWMO</td></tr>
<tr><td colspan="2" rowspan="3">Project Title: Wildland Fire Mitigation Resource Mapping and Inventory Program.</td><td colspan="2">Contact Person: Darryl Oliveira</td></tr>
<tr><td colspan="2">Phone: 961-8297</td></tr>
<tr><td colspan="2">e-mail: cntyfire@interpac.net</td></tr>
<tr><td colspan="4">Hazard(s): Drought, fire</td></tr>
<tr><td>Flood Zone: n/a</td><td>Base Flood Elevation: n/a</td><td colspan="2">Erosion Rate: n/a</td></tr>
<tr><td colspan="4">Critical Facility/Population/Asset at Risk:
At risk assets and populations are numerous and extensive based on the island wide scope of this project. Specific “at risk” assets and populations would be identified based upon the degree of wildland urban interface and the potential and probability for wildland fire impact.</td></tr>
<tr><td colspan="2">Environmental Impact:
High Medium Low</td><td colspan="2">Historical Preservation Impact:
High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:
High Medium Low</td><td colspan="2">Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project: $75,000</td><td colspan="2">Project Period (duration): Two (2) Years</td></tr>
<tr><td colspan="4">Estimated Value of Structure or Facility:</td></tr>
<tr><td colspan="4">Sources of Financial Support: Grants, US Forestry Service</td></tr>
<tr><td colspan="4">Project Objectives:

Continued development and maintenance of a GIS map and database to identify the location, type, and contact information for various wildland fire protection resources.</td></tr>
<tr><td colspan="4">Project Description:

Through a collaborative effort on the part of the various wildland fire protection agencies, a detailed resource GIS mapping system and data base has been established in target communities based on the likelihood of impact by wildfire. This resource inventory and tracking system provides rapid access and identification of a myriad of information to include; the location and type of available static water sources, access roads and bridge capacities, property owners, at risk residents and fixed assets, special environmental or archeological assets, and the respective points or persons of contact. These detailed maps are made available to all emergency response agencies to facilitate effective and expeditious response and incident mitigation. Given the support of additional funding, this project may be expanded island wide and provide valuable resource information to support more effective fire suppression as well as minimize or reduce the exposure of wildfire to community populations and properties. Furthermore, funding is sought to provide for scheduled update and revision of the database and maps based on the continued growth and changes of island communities.</td></tr>
<tr><td colspan="4">Proposal Date: August 2004</td></tr>
</table>

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM: WF-2

<table>
<tr><td colspan="2">Jurisdiction: County of Hawaii</td><td colspan="2">Agency/Organization: S/H DLNR DOFAW, BIWCG, HFD, WHWMO</td></tr>
<tr><td colspan="2" rowspan="3">Project Title: Establish and maintain firebreaks around roads and communities in North and South Kohala districts.</td><td colspan="2">Contact Person: Jay Hatayama</td></tr>
<tr><td colspan="2">Phone: 808-974-4221</td></tr>
<tr><td colspan="2">e-mail: jhatayama@dofawha.org</td></tr>
<tr><td colspan="4">Hazard(s): Wildland Fire, drought, life and property</td></tr>
<tr><td>Flood Zone:</td><td colspan="2">Base Flood Elevation:</td><td>Erosion Rate:</td></tr>
<tr><td colspan="4">Critical Facility/Population/Asset at Risk:
Communities within the areas of Kawaihae, Waikoloa, Waimea, and North and South Kohala.</td></tr>
<tr><td colspan="2">Environmental Impact:

High Medium Low</td><td colspan="2">Historical Preservation Impact:

High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:

High Medium Low</td><td colspan="2">Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project: $2.2 million</td><td colspan="2">Project Period (duration): 15 years</td></tr>
<tr><td colspan="4">Estimated Value of Structure or Facility: $4 billion</td></tr>
<tr><td colspan="4">Sources of Financial Support: US Forest Service grants, community associations, US DOT</td></tr>
<tr><td colspan="4">Project Objectives:

Establish and maintain firebreaks around the highways and communities in the districts of North and South Kohala.</td></tr>
<tr><td colspan="4">Project Description:

1st Year:
$100,000.00 for Environmental Assessment
$600,000.00 for establishing firebreaks (120 miles @ $5000/mile)
$100,000.00 for maintenance of the firebreaks

Next 14 Years:
$100,000.00 for maintenance of the firebreaks</td></tr>
<tr><td colspan="4">Proposal Date: August 2004</td></tr>
</table>

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM: WF-3A

Jurisdiction: County of Hawaii		**Agency/Organization:** Mauna Kea SWCD
Project Title: Install Dry Hydrants and Develop Static Water Sources		**Contact Person:** Ken Kaneshiro
		Phone: (808) 488-6098
		e-mail: kaneshirk001@hawaii.rr.com
Hazard(s): Wildland Fire		
Flood Zone:	**Base Flood Elevation:**	**Erosion Rate:**
Critical Facility/Population/Asset at Risk:		
Environmental Impact: High Medium Low		**Historical Preservation Impact:** High Medium Low
Risk of Hazard Impact: High Medium Low		**Importance to Protection of Life and Property and Recovery from Disaster:** High Medium Low
Estimated Cost of Project: <$10,000 per site		**Project Period (duration):** Long-term
Estimated Value of Structure or Facility:		
Sources of Financial Support: Federal, state, county, or private funding.		
Project Objectives: Install dry hydrants on existing reservoirs in high priority areas for wildland fire suppression.		
Project Description: The establishment of dry hydrants involves installing 6”-10” PVC piping in existing reservoirs to allow fire fighters to pump water out of the reservoirs for fire suppression. The project would include the purchase of materials and construction costs for installation (this may involve the use of heavy equipment). Additionally, agreements would need to be made with the reservoir landowners for dry hydrant construction and the allowed use of the reservoir water. The sites would be selected based on areas of high risk to wildland fire, appropriate access and site conditions, and landowner approvals. The cost estimate for materials is approximately $2000. The installation labor cost could range from $2000 - $8000, depending on existing site conditions. Total cost per site: >$10,000.		
Proposal Date: August 2004		

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM: WF-3B

<table>
<tr><td colspan="2">Jurisdiction: County of Hawaii</td><td colspan="2">Agency/Organization: County of Hawaii Fire Department</td></tr>
<tr><td colspan="2" rowspan="3">Project Title: Remote Automated Weather Stations</td><td colspan="2">Contact Person: Darryl Oliveira</td></tr>
<tr><td colspan="2">Phone: 961-8297</td></tr>
<tr><td colspan="2">e-mail: cntyfire@interpac.net</td></tr>
<tr><td colspan="4">Hazard(s): Drought, Fire</td></tr>
<tr><td>Flood Zone: n/a</td><td colspan="2">Base Flood Elevation: n/a</td><td>Erosion Rate: n/a</td></tr>
<tr><td colspan="4">Critical Facility/Population/Asset at Risk:
Island wide residences and businesses</td></tr>
<tr><td colspan="2">Environmental Impact:

High Medium Low</td><td colspan="2">Historical Preservation Impact:

High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:

High Medium Low</td><td colspan="2">Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project: $85,000</td><td colspan="2">Project Period (duration): five (5) years</td></tr>
<tr><td colspan="4">Estimated Value of Structure or Facility:</td></tr>
<tr><td colspan="4">Sources of Financial Support: US Forest Service, USFWS/DOI</td></tr>
<tr><td colspan="4">Project Objectives:

The establishment and maintenance of Remote Automated Weather Stations in the districts of North Kohala, South Kohala, Kau, Kona, and Mauna Kea.</td></tr>
<tr><td colspan="4">Project Description:

Establish and maintain Remote Automated Weather Stations in high hazard, high probability wildland fire districts. These weather stations will provide critical fire prediction weather data to facilitate effective and safe fire mitigation efforts. Present weather data is extremely limited and inaccurate for the identified target districts. The remote weather station data would be made available to all fire protection agencies and may be further expanded to provide statistical weather data to any and all agencies desiring this information. In addition to providing critical fire behavior data, these units will support the identification and establishment of a “Fire Hazard” warning and communication system whereby environmental conditions can be monitored and tracked to either elevate or downgrade “fire hazard” risk assessments and ultimately prevent potential incidents.</td></tr>
<tr><td colspan="4">Proposal Date: August 2004</td></tr>
</table>

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM: WF-4

<table>
<tr><td colspan="2">Jurisdiction: County of Hawaii</td><td>Agency/Organization: S/H DLNR-DOFAW, BIWCG, CFD, WHWMO</td></tr>
<tr><td colspan="2" rowspan="3">Project Title: Use of Prescribed burns to reduce fuel loads in fire prone areas of Hawaii County</td><td>Contact Person: Jay Hatayama</td></tr>
<tr><td>Phone: 808-974-4221</td></tr>
<tr><td>e-mail: jhatayama@dofawha.org</td></tr>
<tr><td colspan="3">Hazard(s): Drought, Wildland Fire</td></tr>
<tr><td>Flood Zone:</td><td>Base Flood Elevation:</td><td>Erosion Rate:</td></tr>
<tr><td colspan="3">Critical Facility/Population/Asset at Risk:
Communities in N. Kona, S. Kohala, N. Kohala, and endangered species critical habitat in these areas.</td></tr>
<tr><td colspan="2">Environmental Impact:

High Medium Low</td><td>Historical Preservation Impact:

High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:

High Medium Low</td><td>Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project: $1.1 million/yr.</td><td>Project Period (duration): 15 years</td></tr>
<tr><td colspan="3">Estimated Value of Structure or Facility: $7 Billion</td></tr>
<tr><td colspan="3">Sources of Financial Support: USDA, DOI</td></tr>
<tr><td colspan="3">Project Objectives:

Reduce fuel loads along roads and communities in fire prone areas of Hawaii County. Communities would include Waimea, Kawaihae, Puako, Waikoloa, Puu Anahulu and Kailua-Kona.</td></tr>
<tr><td colspan="3">Project Description:

1ST Year:
Develop county-wide strategy and areas to focus on
Environmental Assessment- $100,000.00
Prescribed Burn- $1,000,000 (500 acres at a cost of ~$2000/acre)

Next 14 Years:
Prescribed Burn- $1,000,000 (500 acres at a cost of ~$2000/acre)</td></tr>
<tr><td colspan="3">Proposal Date: August 2004</td></tr>
</table>

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM: WF-5

<table>
<tr><td colspan="2">Jurisdiction: County of Hawaii</td><td colspan="2">Agency/Organization: WHWMO, County of Hawaii Fire Dept., DOFAW</td></tr>
<tr><td colspan="2" rowspan="3">Project Title: Roadside fuel Management Project.</td><td colspan="2">Contact Person: Mick Castillo</td></tr>
<tr><td colspan="2">Phone: 938-0347</td></tr>
<tr><td colspan="2">e-mail: mickcastillo@hawaii.rr.com</td></tr>
<tr><td colspan="4">Hazard(s): Drought, Fire</td></tr>
<tr><td>Flood Zone: n/a</td><td colspan="2">Base Flood Elevation: n/a</td><td>Erosion Rate: n/a</td></tr>
<tr><td colspan="4">Critical Facility/Population/Asset at Risk:
Communities and subdivisions along roads.</td></tr>
<tr><td colspan="2">Environmental Impact:

High Medium Low</td><td colspan="2">Historical Preservation Impact:

High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:

High Medium Low</td><td colspan="2">Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project:</td><td colspan="2">Project Period (duration):</td></tr>
<tr><td colspan="4">Estimated Value of Structure or Facility:</td></tr>
<tr><td colspan="4">Sources of Financial Support: USDOT, HDOT, County DPW, DLNR Land Management, private landowners, DOI/USFS</td></tr>
<tr><td colspan="4">Project Objectives:

The establishment and maintenance of a roadside fuel management program for the South Kohala District.</td></tr>
<tr><td colspan="4">Project Description:

Funding would be utilized to develop, establish, and maintain a roadside fuel management program along an identified corridor of Highway 190, South Kohala/North Kona. Presently, a small-scale fuel management program has been initiated within an identified high-risk area based on collected fire data. Although true program success will be measured based upon a comparison study of past, present, and future fire statistics for this area, present fuel loads have been significantly reduced thereby reducing the wildfire potential. Given the effectiveness of a variety of fuel management techniques that include herbicide spraying, grazing, and mowing, it is recommended that a larger scale endeavor be implemented. This project would have a definite impact on the life safety of area residents as well as prevent the loss of property and irreplaceable native flora.</td></tr>
<tr><td colspan="4">Proposal Date: August 2004</td></tr>
</table>

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM: WF-6

Jurisdiction: County of Hawaii		**Agency/Organization:** WHWMO
Project Title: Agricultural Practices to Mitigate Wildland Fires in Communities and Subdivisions		**Contact Person:** Mick Castillo **Phone:** 938-0347 **e-mail:** mickcastillo@hawaii.rr.com
Hazard(s): Drought, Fire		
Flood Zone:	**Base Flood Elevation:**	**Erosion Rate:**
Critical Facility/Population/Asset at Risk: Residences and subdivisions		
Environmental Impact: High Medium Low		**Historical Preservation Impact:** High Medium Low
Risk of Hazard Impact: High Medium Low		**Importance to Protection of Life and Property and Recovery from Disaster:** High Medium Low
Estimated Cost of Project:		**Project Period (duration):**
Estimated Value of Structure or Facility:		
Sources of Financial Support: USDOT, HDOT, County DPW, DLNR Land Management, private landowners, DOI/USFS		

Project Objectives:

To expand and promote use of livestock as a fuels management tool to reduce fire risk around rural and semi-rural communities.

Project Description:

Utilize current ongoing projects for expansion into other areas, for example, Kawaihae grazing to protect grazing lands from urban village. Tailor project for each community using different animals – sheep or cattle, fencing as appropriate and available infrastructure.

Landowners may also receive tax benefits by using grazing practices to mitigate wildland fire. If there is no fencing in open areas of the property, the land may be taxed at a lower rate as pasture use. Therefore, grazing can be used to reduce fire danger while the landowner gets a tax break.

Areas:

Proposal Date: August 2004

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM: AG-1A

<table>
<tr><td colspan="2">Jurisdiction: County of Hawaii</td><td colspan="2">Agency/Organization: HDOA/ARMD, NRCS</td></tr>
<tr><td colspan="2" rowspan="3">Project Title: Improvements to Old Plantation Systems; Lower Hamakua Ditch</td><td colspan="2">Contact Person: Brian Kau</td></tr>
<tr><td colspan="2">Phone: 973-9473</td></tr>
<tr><td colspan="2">e-mail: brian.k.kau@hawaii.gov</td></tr>
<tr><td colspan="4">Hazard(s): Drought</td></tr>
<tr><td>Flood Zone:</td><td>Base Flood Elevation:</td><td colspan="2">Erosion Rate:</td></tr>
<tr><td colspan="4">Critical Facility/Population/Asset at Risk:
Farms and Ranches for Hamakua, water for fire fighting</td></tr>
<tr><td colspan="2">Environmental Impact:

High Medium Low</td><td colspan="2">Historical Preservation Impact:

High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:

High Medium Low</td><td colspan="2">Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project: approximately $30,000,000</td><td colspan="2">Project Period (duration) 10 years</td></tr>
<tr><td colspan="4">Estimated Value of Structure or Facility: $300,000,000</td></tr>
<tr><td colspan="4">Sources of Financial Support: NRCS, State of Hawaii</td></tr>
<tr><td colspan="4">Project Objectives:

Provide reliable agricultural irrigation water to farmers and ranchers in the Hamakua area via the Lower Hamakua Ditch in times of normal and drought conditions.
Assist in fire-fighting efforts.</td></tr>
<tr><td colspan="4">Project Description:

System wide improvements to the Lower Hamakua Ditch, including but not limited to new flumes, reservoirs, intakes, and distribution systems. Additional work includes lining of existing reservoirs and ditches and tunnel repairs to decrease system losses.

This is an ongoing project for which funding is desired for future improvements to the system.</td></tr>
<tr><td colspan="4">Proposal Date: August 2004</td></tr>
</table>

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM: AG-1B

<table>
<tr><td colspan="2">Jurisdiction: County of Hawaii</td><td>Agency/Organization: Mauna Kea Agribusiness, Kau SWCD, DOA, DWS, NRCS</td></tr>
<tr><td colspan="2" rowspan="3">Project Title: Renovations/Improvements to Water Tunnels and Ditches (old Kau Sugar system)</td><td>Contact Person: John Cross, Randy Cabral</td></tr>
<tr><td>Phone: (808) 928-9012</td></tr>
<tr><td>e-mail:</td></tr>
<tr><td colspan="3">Hazard(s): Drought</td></tr>
<tr><td>Flood Zone: N/A</td><td>Base Flood Elevation: N/A</td><td>Erosion Rate: N/A</td></tr>
<tr><td colspan="3">Critical Facility/Population/Asset at Risk:
Agricultural producers in the Pahala area, livestock producers</td></tr>
<tr><td colspan="2">Environmental Impact:
High Medium Low</td><td>Historical Preservation Impact:
High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:
High Medium Low</td><td>Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project: $2.5M - $3M</td><td>Project Period (duration)</td></tr>
<tr><td colspan="3">Estimated Value of Structure or Facility:</td></tr>
<tr><td colspan="3">Sources of Financial Support: NRCS, private funding sources, State of Hawaii DLNR</td></tr>
<tr><td colspan="3">Project Objectives:

To provide a source of adequate water for agriculture, livestock and fire fighting on former sugar cane lands in the Pahala area.</td></tr>
<tr><td colspan="3">Project Description:

Numerous water development tunnels were constructed by (Kau Sugar Co.) Plantation to provide water for its sugar operations. Several studies have been done in the past, which identifies these water sources, and water flows. These tunnels could provide substantial amounts of water if these tunnels and ditches were reactivated and improved. Water transmission lines and storage would also need to be developed.</td></tr>
<tr><td colspan="3">Proposal Date: August 2004</td></tr>
</table>

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM: AG-1C

<table>
<tr><td colspan="2">Jurisdiction: County of Hawaii</td><td colspan="2">Agency/Organization: HDOA/ARMD, NRCS, Parker Ranch</td></tr>
<tr><td colspan="2" rowspan="3">Project Title: Improvements to Old Irrigation System; Waimea</td><td colspan="2">Contact Person: Brian Kau</td></tr>
<tr><td colspan="2">Phone: 973-9473</td></tr>
<tr><td colspan="2">e-mail: brian.k.kau@hawaii.gov</td></tr>
<tr><td colspan="4">Hazard(s): Drought</td></tr>
<tr><td>Flood Zone:</td><td>Base Flood Elevation:</td><td colspan="2">Erosion Rate:</td></tr>
<tr><td colspan="4">Critical Facility/Population/Asset at Risk:
Farms for Waimea, livestock, fire-fighting</td></tr>
<tr><td colspan="2">Environmental Impact:

High Medium Low</td><td colspan="2">Historical Preservation Impact:

High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:

High Medium Low</td><td colspan="2">Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project: $26,000,000</td><td colspan="2">Project Period (duration): 10 years</td></tr>
<tr><td colspan="4">Estimated Value of Structure or Facility: $100,000,000</td></tr>
<tr><td colspan="4">Sources of Financial Support: NRCS, State of Hawaii, Parker Ranch</td></tr>
<tr><td colspan="4">Project Objectives:

To alleviate the agricultural water shortage problems caused by the inadequate quantity and distribution of water for crop irrigation, livestock drinking water and fire fighting in the watershed area.</td></tr>
<tr><td colspan="4">Project Description:

Increase the storage capacity of the Waimea Irrigation System by constructing a new reservoir in Kauahi to lessen the effect of drought and possibly expand the farming community. Improve distribution systems by installing new irrigation lines to provide for expansion of the Lalamilo Farm Lots. Increase the reliability of the irrigation water supply by upgrading lines, lining Waimea Reservoir and adding storage.

Investigate the use of wells for additional source.</td></tr>
<tr><td colspan="4">Proposal Date: August 2004</td></tr>
</table>

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM: AG-1D

Jurisdiction: County of Hawaii		**Agency/Organization:**
Project Title: Improvements to Old Irrigation System; Kohala		**Contact Person:**
		Phone:
		e-mail:
Hazard(s):		
Flood Zone:	**Base Flood Elevation:**	**Erosion Rate:**
Critical Facility/Population/Asset at Risk:		
Environmental Impact: High Medium Low		**Historical Preservation Impact:** High Medium Low
Risk of Hazard Impact: High Medium Low		**Importance to Protection of Life and Property and Recovery from Disaster:** High Medium Low
Estimated Cost of Project:		**Project Period (duration)**
Estimated Value of Structure or Facility:		
Sources of Financial Support:		
Project Objectives: Make improvements to an existing irrigation system in Kohala for agriculture irrigation uses.		
Project Description: Project description and cost estimates need to be developed through further investigation.		
Proposal Date: August 2004		

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM: AG-2A

<table>
<tr><td colspan="2">Jurisdiction: County of Hawaii</td><td colspan="2">Agency/Organization: Mauna Kea Agribusiness, Kau SWCD</td></tr>
<tr><td colspan="2" rowspan="3">Project Title: Pahala Mill Well Renovation</td><td colspan="2">Contact Person: John Cross</td></tr>
<tr><td colspan="2">Phone: (808) 928-9012</td></tr>
<tr><td colspan="2">e-mail:</td></tr>
<tr><td colspan="4">Hazard(s): Drought</td></tr>
<tr><td>Flood Zone: N/A</td><td colspan="2">Base Flood Elevation: N/A</td><td>Erosion Rate: N/A</td></tr>
<tr><td colspan="4">Critical Facility/Population/Asset at Risk:
Agricultural producers in the Pahala area</td></tr>
<tr><td colspan="2">Environmental Impact:

High Medium Low</td><td colspan="2">Historical Preservation Impact:

High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:

High Medium Low</td><td colspan="2">Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project: $2M - $2.5M</td><td colspan="2">Project Period (duration):</td></tr>
<tr><td colspan="4">Estimated Value of Structure or Facility:</td></tr>
<tr><td colspan="4">Sources of Financial Support:</td></tr>
<tr><td colspan="4">Project Objectives:

To provide a reliable source of water for the farmers and for fire fighting in the Pahala area, and a potential potable water source.</td></tr>
<tr><td colspan="4">Project Description:

The Pahala Well was abandoned when Kau Sugar Co. went out of business in the mid-1990s. The well is capable of producing over 6 million gallons of water per day. The well pumps, controls, etc. would need to be replaced or renovated if possible. Water transmission lines also need to be established. Storage reservoirs may also be required.</td></tr>
<tr><td colspan="4">Proposal Date: August 2004</td></tr>
</table>

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM: AG-2B

<table>
<tr><td colspan="2">Jurisdiction: County of Hawaii</td><td>Agency/Organization: NRCS, HDOA/ARMD</td></tr>
<tr><td colspan="2" rowspan="3">Project Title: Renovate Old Plantation Well; Honokaa/Hamakua</td><td>Contact Person: Doug Toews, Brian Kau</td></tr>
<tr><td>Phone: 541-2600 x126, 973-9473</td></tr>
<tr><td>e-mail: doug.toews@hi.usda.gov, brian.k.kau@hawaii.gov</td></tr>
<tr><td colspan="3">Hazard(s): Drought</td></tr>
<tr><td>Flood Zone:</td><td>Base Flood Elevation:</td><td>Erosion Rate:</td></tr>
<tr><td colspan="3">Critical Facility/Population/Asset at Risk:
Farms and Ranches for Honokaa/Hamakua</td></tr>
<tr><td colspan="2">Environmental Impact:
High Medium Low</td><td>Historical Preservation Impact:
High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:
High Medium Low</td><td>Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project: approximately $100,000</td><td>Project Period (duration) 6 months</td></tr>
<tr><td colspan="3">Estimated Value of Structure or Facility: $1,000,000</td></tr>
<tr><td colspan="3">Sources of Financial Support: NRCS, community</td></tr>
<tr><td colspan="3">Project Objectives:

Place Hamakua Slaughterhouse well into operation for emergency non-potable, agricultural water usage.</td></tr>
<tr><td colspan="3">Project Description:

Purchase and install a pump, irrigation line, storage tanks, and appurtenant works to use the Hamakua slaughterhouse well for emergency drought irrigation water. The well is already drilled and cased. All costs of maintaining and operating the pump must be born by the users of the system.</td></tr>
<tr><td colspan="3">Proposal Date: August 2004</td></tr>
</table>

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM: AG-2C

<table>
<tr><td colspan="2">Jurisdiction: County of Hawaii</td><td colspan="2">Agency/Organization:</td></tr>
<tr><td colspan="2" rowspan="3">Project Title: Renovate Plantation Well; Kohala</td><td colspan="2">Contact Person:</td></tr>
<tr><td colspan="2">Phone:</td></tr>
<tr><td colspan="2">e-mail:</td></tr>
<tr><td colspan="4">Hazard(s): Drought</td></tr>
<tr><td>Flood Zone:</td><td>Base Flood Elevation:</td><td colspan="2">Erosion Rate:</td></tr>
<tr><td colspan="4">Critical Facility/Population/Asset at Risk:</td></tr>
<tr><td colspan="2">Environmental Impact:

High Medium Low</td><td colspan="2">Historical Preservation Impact:

High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:

High Medium Low</td><td colspan="2">Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project:</td><td colspan="2">Project Period (duration)</td></tr>
<tr><td colspan="4">Estimated Value of Structure or Facility:</td></tr>
<tr><td colspan="4">Sources of Financial Support:</td></tr>
<tr><td colspan="4">Project Objectives:

Rehabilitate and renovate an existing plantation well in Kohala for agriculture irrigation uses.</td></tr>
<tr><td colspan="4">Project Description:

Project description and cost estimates need to be developed through further investigation.</td></tr>
<tr><td colspan="4">Proposal Date: August 2004</td></tr>
</table>

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM: AG-3

Jurisdiction: County of Hawaii		**Agency/Organization:** USDA/NRCS
Project Title: Construct new wells, surface water diversions, storage and transmission lines in priority areas.		**Contact Person:** Harry Toki **Phone:** (808) 933-8353 **e-mail:** harry.toki@hi.usda.gov
Hazard(s): Drought		
Flood Zone:	**Base Flood Elevation:**	**Erosion Rate:**
Critical Facility/Population/Asset at Risk:		
Environmental Impact: High Medium Low		**Historical Preservation Impact:** High Medium Low
Risk of Hazard Impact: High Medium Low		**Importance to Protection of Life and Property and Recovery from Disaster:** High Medium Low
Estimated Cost of Project:		**Project Period (duration):** long-term
Estimated Value of Structure or Facility:		
Sources of Financial Support: State, County, Federal, and private sources		
Project Objectives: Increase water supply, storage and delivery/availability during drought.		
Project Description: Investigate and locate appropriate sites to install wells, storage reservoirs and transmission lines within or adjacent to priority areas prior to drought to mitigate drought conditions as it occurs (to be utilized in emergencies). Cost will vary due to locations, type of construction, etc. Need to be determined at each site. Wells to be installed where feasible. Reservoirs installed where needed. To be recharged by wells and/or catchment. Transmission lines to reservoirs from wells, from reservoirs to fields, tanks, and/or standpipes.		
Proposal Date: August 2004		

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM: AG-7

<table>
<tr><td colspan="2">Jurisdiction: County of Hawaii</td><td colspan="2">Agency/Organization: USDA-NRCS, DOA, UH-Cooperative Extension Svc., DLNR, County Dept. of Water, DOH, EPA</td></tr>
<tr><td colspan="2" rowspan="3">Project Title: Irrigating Wisely</td><td colspan="2">Contact Person: Matt Wung</td></tr>
<tr><td colspan="2">Phone: (808) 885-6602 ext.106</td></tr>
<tr><td colspan="2">e-mail: matthew.wung@hi.usda.gov</td></tr>
<tr><td colspan="4">Hazard(s): Drought, Erosion, Excess water use, crop loss, fire</td></tr>
<tr><td>Flood Zone:</td><td>Base Flood Elevation:</td><td colspan="2">Erosion Rate: medium</td></tr>
<tr><td colspan="4">Critical Facility/Population/Asset at Risk:
All farms or projects where crops are irrigated</td></tr>
<tr><td colspan="2">Environmental Impact: runoff with nutrients or pesticides
High Medium Low</td><td colspan="2">Historical Preservation Impact:
High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:
High Medium Low</td><td colspan="2">Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project: $50,000-$100,000</td><td colspan="2">Project Period (duration): long-term</td></tr>
<tr><td colspan="4">Estimated Value of Structure or Facility:</td></tr>
<tr><td colspan="4">Sources of Financial Support: USDA Farm Bill Programs, EPA</td></tr>
<tr><td colspan="4">Project Objectives:

To promote better irrigation practices and water management.</td></tr>
<tr><td colspan="4">Project Description:

Form a steering committee to develop and implement the County-wide program which includes the following key elements:
• Educate the UH-Cooperative Extension Specialists and NRCS field staff on the latest irrigation and soil moisture measuring technologies
• Hold workshops or field days that educate the public on practices that conserve irrigation water
• Promote sustainable agricultural systems that utilize wastewater, intercropping, trees, mulching, and aquaculture in the system.
• Distribute UH publication on drought tolerant plants to interested persons
• Cost share may be available through NRCS</td></tr>
<tr><td colspan="4">Proposal Date: August 2004</td></tr>
</table>

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM: AG-9

Jurisdiction: County of Hawaii		**Agency/Organization:** NRCS, HDOA
Project Title: Agricultural Water System for Kona; Honomalino		**Contact Person:** Brian Kau **Phone:** **e-mail:**
Hazard(s): Drought		
Flood Zone:	**Base Flood Elevation:**	**Erosion Rate:**
Critical Facility/Population/Asset at Risk: Agricultural producers, livestock, fire-fighting		
Environmental Impact: High Medium Low		**Historical Preservation Impact:** High Medium Low
Risk of Hazard Impact: High Medium Low		**Importance to Protection of Life and Property and Recovery from Disaster:** High Medium Low
Estimated Cost of Project:		**Project Period (duration):** Long term
Estimated Value of Structure or Facility:		
Sources of Financial Support: DOA, NRCS, private		
Project Objectives: To provide a reliable source of water for agriculture and for fire-fighting assistance.		
Project Description: This project is in preliminary planning stages to develop a water system. Based on findings, specific costs and timelines will be developed. The area under consideration ranges from 500 to 8,000 acres.		
Proposal Date: August 2004		

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM: WS-1

Jurisdiction: County of Hawaii	**Agency/Organization:** Dept. of Water Supply	
Project Title: Emergency Community Water Stations	**Contact Person:** Glenn Ahuna/Shari Komata	
	Phone: 961-8070	
	e-mail: dws@hawaiidws.org	
Hazard(s): Drought		
Flood Zone:	**Base Flood Elevation:**	**Erosion Rate:**
Critical Facility/Population/Asset at Risk: Persons on Catchment Systems		
Environmental Impact: High Medium Low	**Historical Preservation Impact:** High Medium Low	
Risk of Hazard Impact: High Medium Low	**Importance to Protection of Life and Property and Recovery from Disaster:** High Medium Low	
Estimated Cost of Project: $1,000,000	**Project Period (duration):** 2 years	
Estimated Value of Structure or Facility: $900,000		
Sources of Financial Support: County of Hawaii, HUD CDBG funds		
Project Objectives: Develop permanent emergency drinking water spigot system to provide potable water to populations on water catchment systems.		
Project Description: The project involves clearance of site, paving, construction of a shelter for the spigot, installation of the water spigot, hook up to the water system, fencing the property for security, lighting and other amenities. Six other projects are presently under design.		
Proposal Date: August 2004		

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM: WS-2A

<table>
<tr><td colspan="2">Jurisdiction: County of Hawaii</td><td colspan="2">Agency/Organization: DHHL</td></tr>
<tr><td colspan="2" rowspan="3">Project Title: Development of wells, storage and transmission system for Puukapu.</td><td colspan="2">Contact Person: Jim DuPont</td></tr>
<tr><td colspan="2">Phone: 887-6053</td></tr>
<tr><td colspan="2">e-mail: jim.w.dupont@hawaii.gov</td></tr>
<tr><td colspan="4">Hazard(s): Drought, fire</td></tr>
<tr><td>Flood Zone:</td><td colspan="2">Base Flood Elevation:</td><td>Erosion Rate:</td></tr>
<tr><td colspan="4">Critical Facility/Population/Asset at Risk:
Residences, fire-fighting</td></tr>
<tr><td colspan="2">Environmental Impact:

High Medium Low</td><td colspan="2">Historical Preservation Impact:

High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:

High Medium Low</td><td colspan="2">Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project: $2.0-20 million</td><td colspan="2">Project Period (duration) 5-10 years</td></tr>
<tr><td colspan="4">Estimated Value of Structure or Facility:</td></tr>
<tr><td colspan="4">Sources of Financial Support: Federal, State</td></tr>
<tr><td colspan="4">Project Objectives:

Provide domestic water to 177 ranch lots that presently have limited access to water. Area encompasses approximately 10,000 acres.</td></tr>
<tr><td colspan="4">Project Description:

Obtain funding to identify and develop domestic water source; design transmission and storage system; limited infrastructure; improve and upgrade existing 4” transmission lines; construct transmission system.</td></tr>
<tr><td colspan="4">Proposal Date: August 2004</td></tr>
</table>

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM: WS-2B

<table>
<tr><td colspan="2">Jurisdiction: County of Hawaii</td><td colspan="2">Agency/Organization: DHHL</td></tr>
<tr><td colspan="2" rowspan="3">Project Title: Development and extension of domestic water transmission system for Kawaihae.</td><td colspan="2">Contact Person: Jim DuPont</td></tr>
<tr><td colspan="2">Phone: 887-6053</td></tr>
<tr><td colspan="2">e-mail: jim.w.dupont@hawaii.gov</td></tr>
<tr><td colspan="4">Hazard(s): Drought, fire</td></tr>
<tr><td>Flood Zone:</td><td colspan="2">Base Flood Elevation:</td><td>Erosion Rate:</td></tr>
<tr><td colspan="4">Critical Facility/Population/Asset at Risk:
Commercial/light industrial area, residential subdivision,</td></tr>
<tr><td colspan="2">Environmental Impact:

High Medium Low</td><td colspan="2">Historical Preservation Impact:

High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:

High Medium Low</td><td colspan="2">Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project: $10 million</td><td colspan="2">Project Period (duration): 5-10 years</td></tr>
<tr><td colspan="4">Estimated Value of Structure or Facility:</td></tr>
<tr><td colspan="4">Sources of Financial Support: Federal, State, County</td></tr>
<tr><td colspan="4">Project Objectives:

Expand County water system to Kawaihae area beyond 4.5-mile marker.</td></tr>
<tr><td colspan="4">Project Description:

Obtain funding to identify and develop domestic water sources; design transmission and storage system; improve and upgrade existing 8” transmission lines to accommodate extension of 12” lines; construct transmission system.</td></tr>
<tr><td colspan="4">Proposal Date: August 2004</td></tr>
</table>

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM: WS-2C

<table>
<tr><td colspan="2">Jurisdiction: County of Hawaii</td><td>Agency/Organization:</td></tr>
<tr><td colspan="2" rowspan="3">Project Title: Development and extension of domestic water transmission system for Puna.</td><td>Contact Person:</td></tr>
<tr><td>Phone:</td></tr>
<tr><td>e-mail:</td></tr>
<tr><td colspan="3">Hazard(s): Drought</td></tr>
<tr><td>Flood Zone:</td><td>Base Flood Elevation:</td><td>Erosion Rate:</td></tr>
<tr><td colspan="3">Critical Facility/Population/Asset at Risk:</td></tr>
<tr><td colspan="2">Environmental Impact:
High Medium Low</td><td>Historical Preservation Impact:
High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:
High Medium Low</td><td>Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project:</td><td>Project Period (duration)</td></tr>
<tr><td colspan="3">Estimated Value of Structure or Facility:</td></tr>
<tr><td colspan="3">Sources of Financial Support:</td></tr>
<tr><td colspan="3">Project Objectives:

To provide a domestic water system for the Puna region for residents using rainfall catchment systems.</td></tr>
<tr><td colspan="3">Project Description:

Project description will need to be developed through a planning, engineering, and feasibility study.</td></tr>
<tr><td colspan="3">Proposal Date: August 2004</td></tr>
</table>

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM: WS-2D

<table>
<tr><td colspan="2">Jurisdiction: County of Hawaii</td><td colspan="2">Agency/Organization:</td></tr>
<tr><td colspan="2" rowspan="3">Project Title: Development and extension of domestic water transmission system for Oceanview.</td><td colspan="2">Contact Person:</td></tr>
<tr><td colspan="2">Phone:</td></tr>
<tr><td colspan="2">e-mail:</td></tr>
<tr><td colspan="4">Hazard(s): Drought</td></tr>
<tr><td>Flood Zone:</td><td>Base Flood Elevation:</td><td colspan="2">Erosion Rate:</td></tr>
<tr><td colspan="4">Critical Facility/Population/Asset at Risk:</td></tr>
<tr><td colspan="2">Environmental Impact:

High Medium Low</td><td colspan="2">Historical Preservation Impact:

High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:

High Medium Low</td><td colspan="2">Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project:</td><td colspan="2">Project Period (duration):</td></tr>
<tr><td colspan="4">Estimated Value of Structure or Facility:</td></tr>
<tr><td colspan="4">Sources of Financial Support:</td></tr>
<tr><td colspan="4">Project Objectives:

To provide a domestic water system for the Hawaii Oceanview region for residents using rainfall catchment systems.</td></tr>
<tr><td colspan="4">Project Description:

Project description will need to be developed through a planning, engineering, and feasibility study.</td></tr>
<tr><td colspan="4">Proposal Date: August 2004</td></tr>
</table>

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM: WS-4

<table>
<tr><td colspan="2">Jurisdiction: County of Hawaii</td><td>Agency/Organization: Dept. of Water Supply</td></tr>
<tr><td colspan="2" rowspan="3">Project Title: Makalei Water System Improvements</td><td>Contact Person: Glenn Ahuna/Shari Komata</td></tr>
<tr><td>Phone: 961-8070</td></tr>
<tr><td>e-mail: dws@hawaiidws.org</td></tr>
<tr><td colspan="3">Hazard(s): Drought, fire</td></tr>
<tr><td>Flood Zone:</td><td>Base Flood Elevation:</td><td>Erosion Rate:</td></tr>
<tr><td colspan="3">Critical Facility/Population/Asset at Risk: Keahole Agriculture Lots and Natural Energy Laboratory of Hawaii Authority</td></tr>
<tr><td colspan="2">Environmental Impact:
High Medium Low</td><td>Historical Preservation Impact:
High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:
High Medium Low</td><td>Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project: $5,000,000</td><td>Project Period (duration) 4 years</td></tr>
<tr><td colspan="3">Estimated Value of Structure or Facility: $4,000,000</td></tr>
<tr><td colspan="3">Sources of Financial Support: County of Hawaii</td></tr>
<tr><td colspan="3">Project Objectives:

To ease the water restrictions for the agricultural users in the Kona-Keahole area during periods of drought.</td></tr>
<tr><td colspan="3">Project Description:

Develop additional wells and reservoirs as well as upgrade the transmission system in the area from Keahole to Kailua-Kona. Work may include and is not limited to drilling an exploratory well, outfitting the production well, constructing new reservoirs, and installing and increasing transmission lines.</td></tr>
<tr><td colspan="3">Proposal Date: August 2004</td></tr>
</table>

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM: WS-5

<table>
<tr><td colspan="2">Jurisdiction: County of Hawaii</td><td colspan="2">Agency/Organization: County of HI Dept. of water, DLNR, DOH, USDA-NRCS, DHHL, UH- Extension SVC, Purveyors, impacted communities, County Drought Committee</td></tr>
<tr><td colspan="2" rowspan="3">Project Title: Water Conservation and Watershed Management education</td><td colspan="2">Contact Person: Matt Wung/County Drought Mitigation Committee</td></tr>
<tr><td colspan="2">Phone: (808) 885-6602 ext. 106</td></tr>
<tr><td colspan="2">e-mail: Matthew.wung@hi.usda.gov</td></tr>
<tr><td colspan="4">Hazard(s): Drought, Fire & overuse of water supply</td></tr>
<tr><td>Flood Zone:</td><td>Base Flood Elevation:</td><td colspan="2">Erosion Rate: High</td></tr>
<tr><td colspan="4">Critical Facility/Population/Asset at Risk:
Areas on catchment and areas prone to drought, also county-wide population</td></tr>
<tr><td colspan="2">Environmental Impact:

High Medium Low</td><td colspan="2">Historical Preservation Impact:

High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:

High Medium Low</td><td colspan="2">Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project:</td><td colspan="2">Project Period (duration): year round</td></tr>
<tr><td colspan="4">Estimated Value of Structure or Facility:</td></tr>
<tr><td colspan="4">Sources of Financial Support: Federal, County, and State Agencies</td></tr>
<tr><td colspan="4">Project Objectives:

To mitigate the effects of drought by increasing the public's awareness of water conservation and watershed management.</td></tr>
<tr><td colspan="4">Project Description:

Develop an education and outreach program in coordination with various agencies and organizations which could include:
• A pamphlet on water conservation practices to be distributed in areas on catchment
• Highlight a farm or household that conserves water in local newspapers as public announcements.
• Have field tours to farms practicing water conservation methods.
• Have Kuhea Paraquaqualis (educator from Volcanoes National Park) do a radio announcement on Big Island Minute and a spot on Living in paradise.</td></tr>
<tr><td colspan="4">Proposal Date: August 2004</td></tr>
</table>

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM: WS-9

Jurisdiction: County of Hawaii		**Agency/Organization:** Dept. of Water Supply
Project Title: Various Water System Improvements within the County of Hawaii		**Contact Person:** Glenn Ahuna/Shari Komata **Phone:** 961-8070 **e-mail:** dws@hawaiidws.org
Hazard(s): Drought		
Flood Zone:	**Base Flood Elevation:**	**Erosion Rate:**
Critical Facility/Population/Asset at Risk: The general population in the areas of Puna, Kau, South Kona, South Kohala, Hamakua, and parts of South Hilo		
Environmental Impact: High Medium Low		**Historical Preservation Impact:** High Medium Low
Risk of Hazard Impact: High Medium Low		**Importance to Protection of Life and Property and Recovery from Disaster:** High Medium Low
Estimated Cost of Project: $49,000,000		**Project Period (duration):** 15 years
Estimated Value of Structure or Facility: $44,000,000		
Sources of Financial Support: County of Hawaii		
Project Objectives: To provide sound water systems to meet the needs of the consumers during normal and drought conditions in the Puna, Kau, South Kona, South Kohala, Hamakua, and parts of South Hilo Districts.		
Project Description: Develop additional sources, storage facilities, as well as upgrade the transmission and distribution systems. Work may include and is not limited to drilling an exploratory well, outfitting the production well, constructing new reservoirs, installing and increasing transmission and distribution lines, and any related appurtenances to upgrade the existing water systems.		
Proposal Date: August 2004		

8 REFERENCES

State of Hawaii, Department of Land and Natural Resources, Commission on Water Resource Management. *Hawaii Drought Plan*. Prepared by Wilson Okamoto Corporation, December 2004.

State of Hawaii, Department of Land and Natural Resources, Commission on Water Resource Management. *Drought Risk and Vulnerability Assessment and GIS Mapping Project*. Prepared by University of Hawaii, Social Science Research Institute, September 2003.

State of Hawaii, Department of Defense, Civil Defense Division. *State of Hawaii Hazard Mitigation Plan*. Draft, December 2004.

State of Hawaii, Department of Agriculture. *Agricultural Water Use and Development Plan.* Draft, December 2003.

County of Hawaii, Civil Defense Agency. *County of Hawaii Natural Hazards Mitigation Plan*, 2003.